MAPPING OF HABITAT TYPES THROUGHOUT A NATIONAL FOREST

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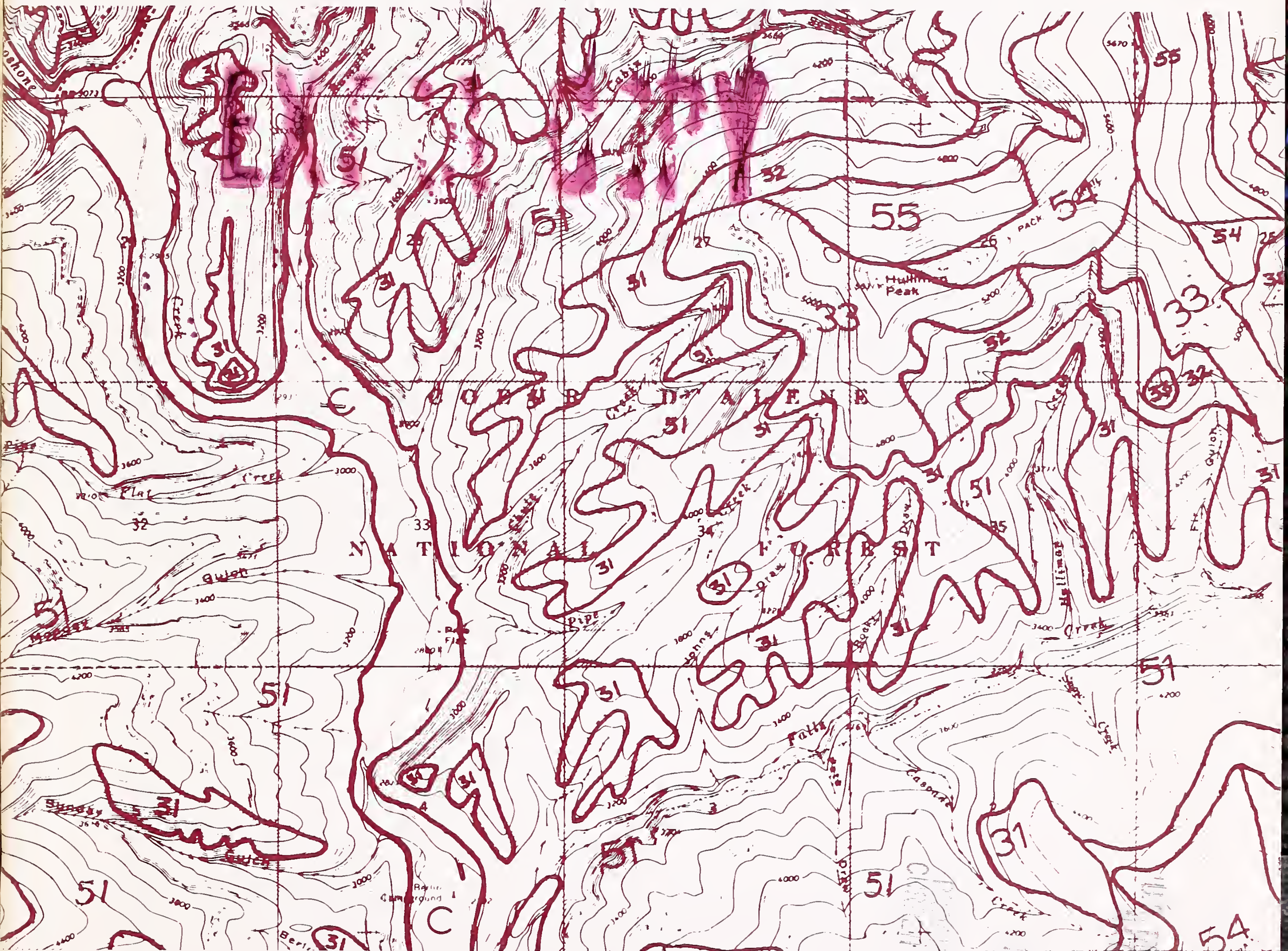

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Young Douglas-fir and ponderosa pine on a steep, thin-soiled, southerly slope that often characterized the occurrence of Douglas-fir/pachistima habitat type.

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FOREWORD

Development of an ecosystem classification for the forest vegetations of the northern Rocky Mountains has provided land managers in this region with an effective means of stratifying the landscape into units of generally equivalent environment for plant growth. In recent years, the Northern Region of the USDA Forest Service has given increasing weight to habitat type identification in site descriptions for multiple use planning in specific stands.

In 1970, the opportunity arose to try mapping habitat types throughout an entire National Forest when a reinventory was made of timber resources on the Coeur d'Alene National Forest in northern Idaho. Procedures for fieldwork and mapping were developed as a joint endeavor by the Northern Region, the Coeur d'Alene National Forest, and the Intermountain Forest and Range Experiment Station.

ABSTRACT

The occurrence of ecologically defined habitat types over the entire Coeur d'Alene National Forest in northern Idaho was mapped in conjunction with a reinventory of the timber resource. This report describes the method of data collection and the observed relationships between habitat type occurrence and topographic variables that were used for interpretive mapping outside of sampled areas.

OXFORD: 182.2, 182.3, 182.58, 582.
KEYWORDS: Migration (plant), associations (plant), vegetation mapping methods, mapping, habitat type, ecosystem classification, topographic relationships.

CONTENTS

Typical terrain of Coeur d'Alene National Forest, showing some of the extensively developed logging road system.

THE ENVIRONMENTAL SETTING

The Coeur d'Alene National Forest contains about 723,000 acres. It extends from the Bitterroot Range on the east where elevations reach 6,800 feet above sea level to the edge of the Columbia Plateau on the west where the elevation drops to near 2,100 feet. The area between is occupied by the Coeur d'Alene Mountains, which resemble an intricately dissected highland. The terrain is generally steep; slopes of 50 to 65 percent are common. Most of the soils on the National Forest are brown Podzolic soils that have developed over rather hard argillite, quartzite, and sandstone and they usually display the influence of loess and volcanic ash mantles.

The climate is markedly influenced by maritime air masses brought in from the Pacific coast by prevailing westerly winds. This results in more cloudiness and precipitation as well as warmer mean temperatures than are experienced in areas farther east having continental climates. As Daubenmire[1] observed, the similarity of Northern Rocky Mountain climate to that of the west slope of the northern Cascades is attested to by the reappearance of western hemlock and western redcedar as climax forest at intermediate elevations. Precipitation at the city of Coeur d'Alene, on the west side of the National Forest, averages 26 inches per year; in the mountains, it increases about 14 inches for every rise of 1,000 feet in elevation. About 65 to 75 percent occurs as snow. Habitat types represented on the National Forest range from ponderosa pine associations on low elevation, dry sites to mainly subalpine fir and mountain hemlock at the highest sites (fig. 1).

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[1]R. F. Daubenmire. Vegetational zonation in the Rocky Mountains. Bot. Rev. 9(6): 325-393, illus. 1943.

Pinus albicaulis/Abies lasiocarpa
(Whitebark pine/subalpine fir)

Tsuga mertensiana/Menziesia ferruginea
(Mountain hemlock/rusty menziesia)

Tsuga mertensiana/Xerophyllum tenax
(Mountain hemlock/beargrass)

Abies lasiocarpa/Menziesia ferruginea
(Subalpine fir/rusty menziesia)

Abies lasiocarpa/Vaccinium scoparium
(Subalpine fir/grouse whortleberry)

Abies lasiocarpa/Xerophyllum tenax
(Subalpine fir/beargrass)

Abies lasiocarpa/Pachistima myrsinites
(Subalpine fir/pachistima)

Pseudotsuga menziesii/Calamagrostis rubescens
(Douglas-fir/pinegrass)

Thuja plicata/Oplopanax horridum
(Western redcedar/devil's-club)

Thuja plicata/Athyrium filix-foemina
(Western redcedar/ladyfern)

Tsuga heterophylla/Pachistima myrsinites
(Western hemlock/pachistima)

Thuja plicata/Pachistima myrsinites
(Western redcedar/pachistima)

Abies grandis/Pachistima myrsinites
(Grand fir/pachistima)

Pseudotsuga menziesii/Physocarpus malvaceus
(Douglas-fir/ninebark)

Pinus ponderosa/Symphoricarpos albus
(Ponderosa pine/snowberry)

Pinus ponderosa/Festuca idahoensis
(Ponderosa pine/Idaho fescue)

Pinus ponderosa/Agropyron spicatum
(Ponderosa pine/bluebunch wheatgrass)

Figure 1.--Habitat types encountered on the Coeur d'Alene National Forest in general order of their expected occurrence on left-to-right gradients of increasing elevation, decreasing temperature, and (less conformably) increasing moisture.

DEVELOPMENT OF MAPPING PROCEDURES

Twenty-seven subcompartments or portions of subcompartments on the National Forest were selected for field sampling in 1971 in accordance with revised inventory system procedures that had been developed to provide "in-place" information on timber volume, growth, mortality, stand condition, and potential productivity.[2] The sampled units totaled about 23,000 acres, slightly over 3 percent of the entire Forest (fig. 2). As a part of the data collection in each of the subcompartments, the same field crews recorded habitat types at sample plot locations that systematically gridded the area at 5-chain intervals along lines 10 chains apart (a rate of about 1 plot per 5 acres). Written record of key vegetation presence and abundance was made at every fifth plot to facilitate supervisory checks on correctness of identification. Initial guidance for training the field crews was obtained from pioneer mapping of habitat types by Daubenmire at the Priest River Experimental Forest in 1967.[3]

For each subcompartment, the habitat type designations for each sample point were entered on a large-scale topographic map (4 inches = 1 mile; contour interval 40 or 80 feet. Using these designations as a base, lines were drawn where a change from one habitat type to another was indicated (fig. 3). Because of the low sampling intensity, no attempt was made to delineate broad ecotones or areas of less than 5 acres. This mapping of sampled units and of a few other areas within the National Forest where limited supplementary reconnaissance had been done confirmed that quite strong relationships existed among habitat type occurrence, geographic location, and certain topographic factors.

The map detail from the subcompartments and reconnoitered points subsequently were transferred to a set of smaller-scale topographic quadrangles (2" = 1 mile), each of which covered 7-1/2' or 15' of longitude and latitude. Using a more-or-less objective extrapolation of the previously determined geographic and topographic relationships to intervening areas, the remaining 96 percent-plus of the Forest then was mapped on the quadrangles as shown on front cover.

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[2]Albert R. Stage and Jack R. Alley. An inventory design using stand examinations for planning and programing timber management. USDA For. Serv. Res. Pap. INT-126, 17 p., illus. 1972.

[3]R. F. Daubenmire. Habitat type mapping feasibility: a report on a cooperative agreement between the Forest Service and Washington State University. Typed report on file at Intermt. For. & Range Exp. Stn., Moscow, Idaho.

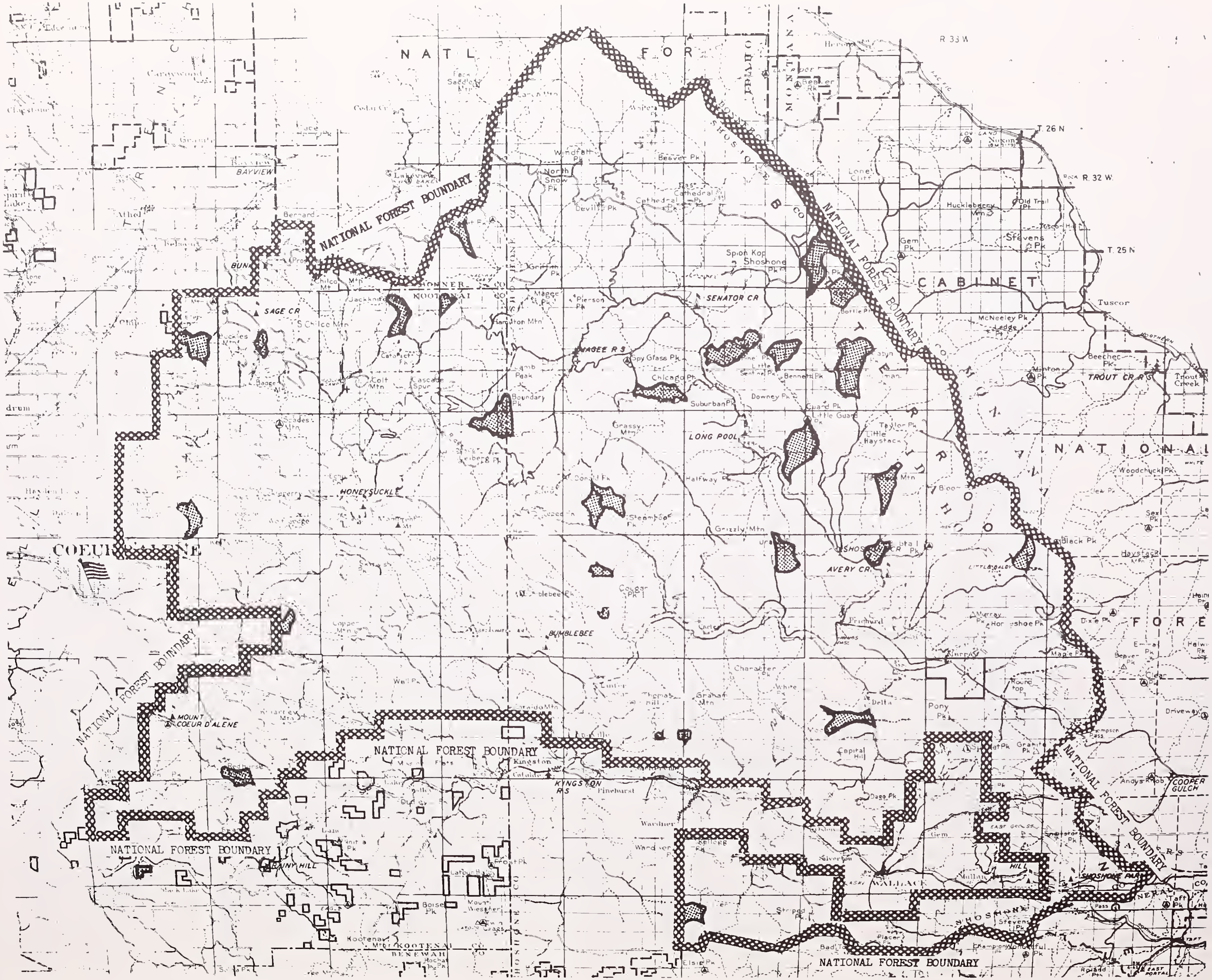

Figure 2.--Location of subcompartment units on the Coeur d'Alene National Forest that were selected for field sampling.

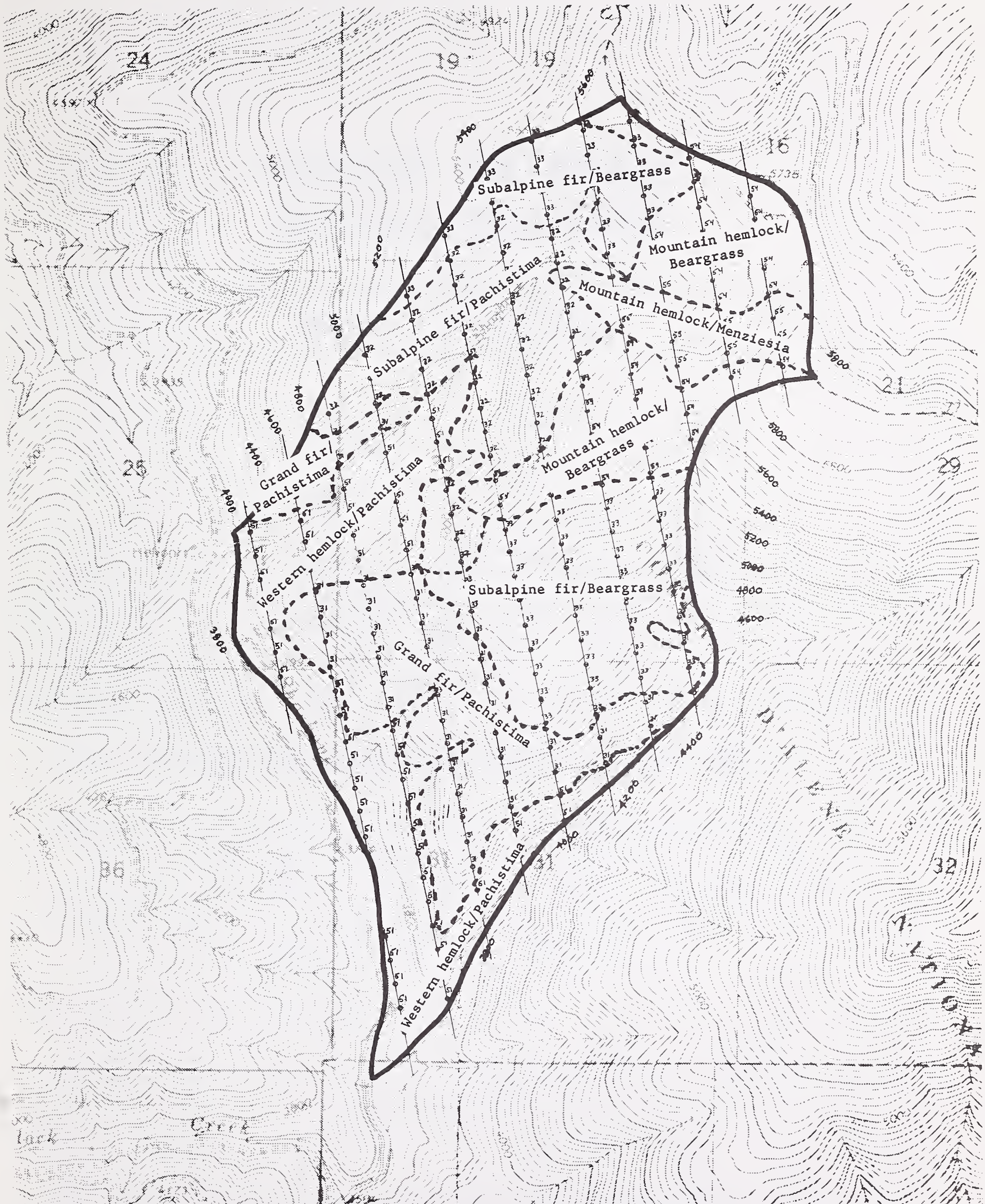

Figure 3.--Subcompartment map showing grid of sample points (each with numerical designation of habitat type) and the derived habitat type boundary lines.

HABITAT TYPES ENCOUNTERED

Total acreages of the principal habitat types, estimated from the final map by dot-grid count, were as follows:

Douglas-fir/ninebark	8,600
Grand fir/pachistima	198,200
Western hemlock/pachistima	374,700
Subalpine fir/pachistima	41,100
Subalpine fir/beargrass	15,900
Subalpine fir/menziesia	5,000
Mountain hemlock/beargrass	35,300
Mountain hemlock/menziesia	19,500
Lowland complexes	22,300
Total	720,600

The extensive representation of western hemlock and grand fir habitat types (more than 80 percent of the area) attests to the generally moderate environmental conditions within the Coeur d'Alene National Forest. Subalpine fir and mountain hemlock were climax on most of the remainder of the area (about 16 percent), not all of which was located at high elevations. The subalpine fir/pachistima habitat type also occurred in frost pocket situations on lower parts of many drainages.

The "lowland complexes" designation includes fairly level areas near lakes and rivers draining into swampy terrain and also includes most of the broad flats that border the lower ends of major mountain streams. Habitat types found in such places (western hemlock/pachistima, western redcedar/ladyfern, western redcedar/devil's-club, subalpine fir/pachistima, and riparian types) were lumped because changes from one to another occurred rapidly and were frequently associated with elevational differences that were too small to be determined on the available topographic maps.

Other habitat types exist on the Forest in isolated patches or stringers usually too small to map at the scale used (fig. 1). Among these, areas having ponderosa pine as the climax tree species were strictly confined to driest exposures at the lowest elevations. The Douglas-fir/pinegrass type was not mapped because its apparent occurrence was a result of repeated severe burns on limited areas of steep south slopes. These areas could not be delineated without field examination; also, there was question about the relative permanency of the retrograded condition in the absence of further wildfires. Western redcedar/pachistima was not differentiated from western hemlock/pachistima because information was not available as to environmental distinctions that could be used to map each of these types individually. The western redcedar/devil's-club and western redcedar/ladyfern types occurred only as very narrow stringers along stream margins at intermediate elevations. Two high-elevation types--subalpine fir/grouse whortleberry and whitebark pine/subalpine fir--rarely were encountered.

ENVIRONMENTAL INFLUENCES

We tentatively had planned to try to develop mathematically-expressed relationships between habitat type occurrence and topographic variables so that computer methods could be used to map the bulk of the National Forest. However, this approach was dropped, because of the complexity of analytical requirements and of time limitations. Instead, the environmental relationships that had been observed, together with those that had been reported by Daubenmire in 1943[1] and in 1968,[4] were used to develop general criteria for interpretive mapping.

Effects of Geographic Location

Differences in growing conditions on the Coeur d'Alene National Forest that are attributed to geographic location are most noticeable between the east and west portions. On the west side, precipitation is relatively low and evapotranspiration is relatively high on the exposed western slopes. This, coupled with the warm temperatures at the lowest elevations, produced the driest climatic conditions that we encountered. As the air masses move eastward, they are cooled as they pass over and beyond the first range of mountains; this causes increased precipitation and corresponding changes in the representation of habitat types. Toward the east side, there is a proportionately greater acreage of high-elevation habitat types because the mountain ranges are higher than those on the west.

Little more than half a degree of latitude separates the northernmost and southernmost extensions of the Forest, which is equivalent to less than 1 percent difference in total yearly energy input in terms of potential solar radiation. By itself, this difference does not appear to cause any significant shifts in the pattern of habitat type occurrence.

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[4]R. Daubenmire and Jean B. Daubenmire. Forest vegetation in eastern Washington and northern Idaho. Wash. Agric. Exp. Stn. Tech. Bull. 60, 104 p., illus. 1968.

Effects of Landform

Elevation, aspect, slope configuration, and adjacent land features are four of the major landform characteristics that exercise strong control over environmental conditions through complex interactions; in turn, the conditions are intimately related to plant distribution. Foremost among these conditions are precipitation, infiltration, evapotranspiration, growing season, soil depth, wind exposure, and cold air drainage.

Elevation

Daubenmire[1] reported that vegetation zones do not exist as rigidly-defined altitudinal belts in the Northern Rocky Mountains, but that the habitat types do bear a generally consistent altitudinal relationship to each other as a consequence of different temperature and moisture optima. How abruptly or how gradually the transition occurs between habitat types on the Coeur d'Alene National Forest (fig. 1) varies with the kind of topographic factor causing the change. On slopes where the factor was elevation rather than aspect or slope configuration, the ecotone was typically broad. Usually it appeared as a mosaic of the merging types in varying degrees of intermediacy. Such mosaics were most frequently encountered at the higher elevations in the ecotones among western hemlock, subalpine fir, and mountain hemlock habitat types.

Aspect

Overall, most of the changes in habitat type were triggered by changes in aspect between opposing sides of a ridge or of a ravine. Areas that faced in southerly to westerly directions were characterized by relatively high heat loads and by greater exposure to drying winds, as well as by the moisture deficiencies that were usually intensified by the occurrence of thinner and rockier soils.[5]

From the standpoint of aspect alone, south-southwest slopes appeared to be driest and conditions became progressively cooler and moister in either clockwise or counterclockwise directions around to the north-northeast. This relationship did not apply only to the aspect of the main slope, but also to internal fluctuations in aspect associated with minor draws--especially those that were sharply incised. As a result, southerly-facing main slopes typically displayed an interfingering of a "moist" habitat type, such as western hemlock, upward in the draws from near the bottom of the main drainage into an overlying drier habitat type, such as grand fir. However, on northerly exposures, internal aspect changes had much less effect and the range of moisture conditions often fell within the requirements of a single habitat type.

Land Configuration

Viewed in cross-section, the shape of the land surface within a given area can be classed as convex, uniform, or concave (fig. 4). Convex surfaces are represented chiefly by upper slopes and ridges. Southerly exposures at these locations on the Coeur d'Alene were markedly drier than those facing the north, so ecotones between habitat types customarily lay near the ridgelines. The ecotone was usually located a short distance over the ridge on the northerly side where moisture conditions became significantly improved. Sometimes, however, deeper soils that occurred in saddles or on broad ridgetops modified the effect of exposure, and then the zone of habitat type transition shifted toward the southerly side of the ridge.

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[5]Nedavia Bethlahmy. Water yield and annual peaks as affected by exposure in mountainous terrain. Intermt. For. & Range Exp. Stn. (Unpubl. manuscript.)

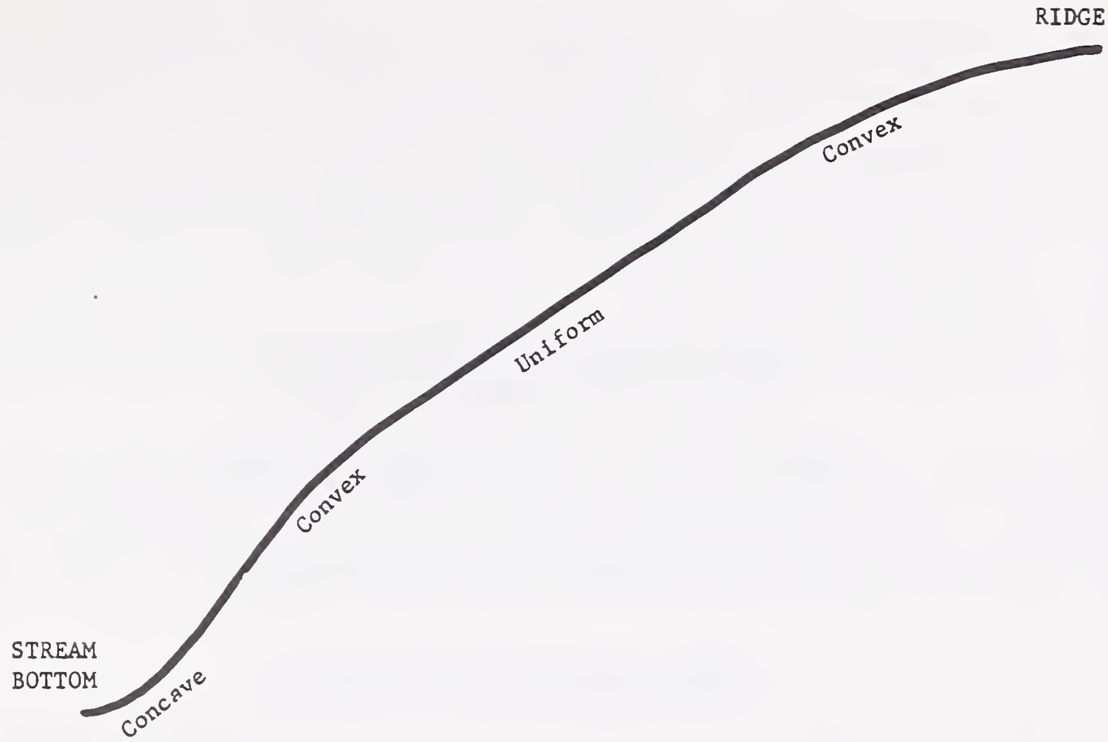

Figure 4.--Diagrammatic cross-section of a mountain slope showing a typical sequence of configuration classes. The same sequences also occur within the draws superimposed on main slopes.

Steeply convex conditions are likely to be especially dry because of greater erosion and consequent thin, rocky soils. Areas of this kind were relatively small, and they were typically encountered toward the lower part of a main slope where a rather abrupt break had been caused by geologically recent stream-cutting action. The local presence of a very dry habitat type was often associated with this configuration, especially on the brow of a southward-descending spur ridge.

The uniform class of configuration is found mainly on midslope positions where its extent is limited by subdrainage development. Changes in habitat type within this kind of area were infrequent and were usually caused by changes in elevation or soil type.

Concave landforms are associated with lower slopes, draws, benches, and stream bottoms. In comparison with the other two classes, the soils in such areas were moister and generally were accompanied by lower air temperatures and higher humidities that resulted from cold air drainage and less direct sunlight. As a consequence of these conditions and of their interactions with aspect, a habitat-type change commonly occurred on the lower portion of southerly slopes; for example, from western hemlock in a ravine to grand fir on the slope above. How far up from the bottom of the ravine that this would happen depended mainly on interrelated factors of aspect, slope configuration, and certain modifying effects of adjacent land features.

Although not considered in the mapping project because of the small size of areas involved, another change in habitat type occurred in concave topography where western redcedar/ladyfern and western redcedar/devil's-club were represented on streamside sites. These types were also limited for the most part to intermediate elevations and to the gentler gradients at lower ends of the drainages.

Adjacent Land Features

The most complex and difficult topographic variables to evaluate are those associated with adjacent land features. The features can range in scale from a neighboring mountain to a nearby spur ridge. Depending upon the size of the feature and distance from a given site, it can have a significant effect at that site on duration of direct sunlight, on wind and other air movement, and on precipitation patterns. For example, observations on the Coeur d'Alene National Forest showed that the ecotone between western hemlock/pachistima and grand fir/pachistima habitat types occurred at noticeably higher elevations on west-facing slopes if there was a high mountain or ridge on the other side of an intervening steep and relatively narrow drainage. The difference was caused by the greater sheltering influence of the adjacent mountain against drying winds from the west and by the early shading of the observed slopes from the afternoon sun.

Constrictions in valley width were responsible for more obvious examples of the effect of adjacent land features. In these locations, pooling of cold air draining from upper slopes created a frostpocket condition, which was accompanied by the appearance of subalpine fir/pachistima habitat type in the valley bottom and in lower portions of adjoining subdrainages for varying distances above the point of constriction.

Effects of Fire

About one-fourth of the Coeur d'Alene National Forest was burned over by the historic fires of 1910. Reburns and sheep grazing on some of these areas in subsequent years have caused the virtual disappearance of key plant species that would have indicated a moister habitat type than seems to be represented now. This inference was drawn from the observed patterns of habitat type occurrence on similarly situated areas in the vicinity that remained relatively undisturbed. Nearly all of the sites showing such incongruity in habitat type were located on steep south- or southwest-facing slopes where soil loss had been heavy. Many were at relatively high elevations where the present vegetation indicated the habitat type to be Douglas-fir/pinegrass.

Although there is some question whether or not the dry conditions presently manifested are permanent enough to warrant this distinction, it seems likely that the retrogressive influences of past disturbance have been so rigorous as to justify the lowered habitat type designation. However, this was not done in our mapping because specific information on site history and on soils throughout the National Forest was not available. Instead, all areas were mapped entirely on the basis of the broadly derived topographic relationships described in foregoing and subsequent sections.

PATTERN OF HABITAT TYPE OCCURRENCE

The main characteristics of habitat type occurrence on the Coeur d'Alene National Forest as they were inferred from inventory plots and limited supplementary reconnaissance are outlined below. The elevational boundaries given are generalized averages, subject to considerable local variation caused by other interacting environmental factors.

Douglas-fir/ninebark --This habitat type is most prevalent on the western side of the Forest where it occupies nearly all southerly-facing sites (southeast to west-northwest)[6] below about 2,400 feet in elevation. Above 2,400 feet, the type becomes increasingly restricted to the more southerly aspects and steeper slopes until at about 3,600 to 3,800 feet it is essentially limited to small rocky areas on the tops of spur ridges that descend steeply to the south. Eastward beyond the first range of mountains, the type occurs only on the latter kind of site.

Grand fir/pachistima.--Along the western front of the Forest, grand fir is climax up to about 2,400 feet on slopes facing northwest to southeast, as well as in drainages on all aspects. From 2,400 feet to about 3,800 feet, the grand fir type replaces Douglas-fir on southerly slopes; from there it extends upward to subalpine habitat types. Eastward from this first range of mountains, east-northeast to west-northwest aspects are generally grand fir type. Above 3,600 feet, however, the type becomes increasingly limited to slopes that face from south to west and that have thinner soils.

Western hemlock/pachistima.--The western hemlock habitat type is first encountered on the west side of the Forest as a narrow stringer in the bottoms of drainages at about

[6]Inclusive compass directions are to be read clockwise.

2,400 feet--somewhat lower in drainages running in a northerly direction and somewhat higher in drainages running southerly. Western hemlock takes over from grand fir on due north-facing slopes at about the same elevation, gradually extending its coverage to the northwest and to the northeast as elevation increases. In the mountains to the east, on the other hand, the western hemlock type rapidly becomes predominant on all northerly slopes (west-northwest to east-southeast) up to subalpine habitats. The distance to which this type extends up the south-facing sides of drainages depends chiefly upon the protection from exposure provided by local features. In addition, western hemlock frequently fingers up ravines into higher elevations dominated by subalpine fir types.

Subalpine fir habitat types.--On the mountains to the west, the relatively small acreage wherein these habitat types are represented is mostly located in the northwest corner of the Forest at elevations above 4,800 feet. Ridges and upper south-to-west slopes are generally classified as subalpine fir/beargrass and slopes of other aspects are generally subalpine fir/pachistima. Proceeding eastward, the trend of elevational occurrence is lower; on the slopes of the Bitterroot Divide, subalpine fir often becomes climax at about 4,400 to 4,500 feet. The subalpine fir/beargrass type again predominates on ridges and dry southeast-to-west exposures on upper slopes. Subalpine fir/pachistima is represented in the draws of dissected southerly slopes, on adjacent southeast and northwest slopes, and, frequently, on all aspects in a rather narrow transitional zone between the beargrass and menziesia climax communities above and grand fir or western hemlock types below. The subalpine fir/menziesia habitat type seldom occurs below about 4,600 feet; it is quite restricted to moist and generally concave topography on north-to-east-facing slopes.

Mountain hemlock habitat types.--Representation of mountain hemlock habitat types is confined mainly to the eastern third of the Forest where they occur at high elevations above the subalpine fir types. Usually the transition to mountain hemlock takes place above 5,000 feet, but the hemlock occasionally replaces subalpine fir at elevations as low as 4,600 feet in northeast and southeast sections of the Forest; the cause for this was not apparent. The two mountain hemlock habitat types follow the same distributional pattern in relation to aspect and exposure as described for subalpine fir.

CONCLUSIONS

On the Coeur d'Alene National Forest, a low intensity of field sampling has given insight into relationships between habitat type and recognized topographic factors that appears good enough to have provided, in turn, a useful habitat type map and general key to vegetation potential of the entire Forest. The map should be regarded as a first approximation; hopefully, it will be corrected and amplified as specific areas are more closely examined during the course of ongoing management activities. Also, additional knowledge about such factors as precipitation patterns, geomorphology, and soils should help to make subsequent interpretive mapping more detailed and precise.

Accuracy of Mapping

Data limitations imposed by the inventory sampling design and inadequate supplementary reconnaissance were mainly responsible for certain shortcomings of the habitat type mapping on the Coeur d'Alene National Forest. Several factors materially affected mapping accuracy, specifically:

1. Some of the minor habitat types were ignored because the individual areas of occurrence were too small to have been adequately observed or to have been mapped at the scale used. Other habitat types were combined because good criteria for their separate identification were lacking. Instances of these kinds are given on page 6.

2. Some habitat types were more reliably identified than others by the field crews, and some ecotones were sharper and could be more readily associated with topographic variables than others. It is fortunate that grand fir and western hemlock were two of the best types in both respects, because together they constituted the climax vegetation on about 80 percent of the National Forest. High elevation types, on the other hand, were often less easily differentiated, their relationships to topographic changes were less clear, and their ecotones were relatively broad and complex.

3. Within the subcompartments selected for inventory sampling, the 5- or 10-chain distance between adjacent plots that differed in habitat type designations frequently left considerable room for speculation about the actual location of the intervening ecotone on the subcompartment map. Errors that may have resulted probably would have been carried over by extrapolative mapping into adjoining parts of the Forest.

4. Extrapolation of habitat type and topographic relationships became less reliable as distances from inventoried subcompartments and reconnoitered points increased.

5. As Daubenmire has reported,[7] cartographic errors in the topographic base map can occur rather frequently on rough forested terrain. Inaccurate road locations are particularly serious because the roads frequently provide key features for on-the-ground orientation. Other base-map faults involve minor breaks or changes in slope direction that the cartographer ignored or could not detect on aerial photographs because of tall tree cover. These omitted features may sometimes be associated with important ecotones, in which case their absence from the map will cause corresponding inaccuracies in the delineation of habitat types within those areas.

Recommended Changes in Mapping Procedures

It has been pointed out that the procedure followed for collecting habitat type information on this National Forest developed as an integral part of the scheduled timber inventory operation. Under other circumstances and in retrospect, it would have been more efficient to employ perhaps two or three professionals well trained in the local ecology to work together for a field season exclusively on mapping of habitat types. Rather than classifying the type at mechanically spaced points within certain sample units, they should first attempt through general reconnaissance to determine the pattern of habitat type occurrence throughout the Forest and to identify the environmental characteristics that might be usefully related. This information would indicate which habitat types were apt to be most difficult to delineate. It would also provide guidance for subsequent allocation of reconnaissance effort that would be more specifically directed toward tracing the actual course of the ecotones in typical situations and toward developing more definitive criteria for interpretive mapping.

In many other parts of the Northern Rocky Mountains, habitat type mapping of forest land promises to be more difficult than it was in the Coeur d'Alene National Forest. Not only did the Coeur d'Alene have an unusually good network of roads available for reconnaissance, but the degree of diversity in climate, soils, and topography was comparatively moderate. More variable conditions, such as are being encountered in western Montana,[8] will increase the number and distributional complexity of habitat types, making the need for competent personnel and detailed reconnaissance even more imperative.

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[7]R. Daubenmire. A comparison of approaches to the mapping of forest land for intensive management. For. Chron. 48(2):87-91, illus. 1973.

[8]Personal communication with Robert D. Pfister, Forest Ecologist, Intermt. For. & Range Exp. Stn., stationed at the Forestry Sciences Laboratory in Missoula, Montana.

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Headquarters for the Intermountain Forest and Range Experiment Station are in Ogden, Utah. Field Research Work Units are maintained in:

Boise, Idaho
Bozeman, Montana (in cooperation with Montana State University)
Logan, Utah (in cooperation with Utah State University)
Missoula, Montana (in cooperation with University of Montana)
Moscow, Idaho (in cooperation with the University of Idaho)
Provo, Utah (in cooperation with Brigham Young University)
Reno, Nevada (in cooperation with the University of Nevada)

Grand fir/pachistima habitat type as represented on a mid-elevation ridgetop site.

Photo on back cover shows western hemlock/pachistima habitat type as represented on a lower north-facing slope.